REMARKS

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended claim 6 to further define the apparatus used in the process; specifically, to recite that the method uses apparatus including, inter alia a gas supply plate in the vacuum processing chamber, and that a side wall of the vacuum processing chamber includes a temperature adjustment side wall which is positioned in an upper part of the side wall of the vacuum processing chamber, the temperature adjustment side wall surrounding a plasma generating area located between the sample table and the gas supply plate, and a temperature controlling means for controlling a temperature of the temperature adjustment side wall by using a coolant medium; to delete the "wherein" clause, prior to recitation of the process steps specifying how the plasma processing is carried out; to recite that the plasma is generated in the plasma generating area in response to introduction of a gas which contains at least carbon and fluorine for processing the sample; and to recite that concurrently with the plasma generating step, a temperature of the temperature adjustment side wall is controlled to be in a range of 10° C - 120° C, with a temperature control accuracy of the temperature adjustment side wall, in the controlling, being ±5° C for restraining a gas species discharge from the temperature adjustment side wall which contains carbon and fluorine according to a plasma dissociation. Note, for example, Fig. 1, and the description in connection therewith on pages 13 and 14 of Applicants' Substitute Specification submitted in the present application with the Preliminary Amendment filed March 23, 2000 (hereinafter Applicants'

Substitute Specification); and also the description on pages 30-34 of Applicants' Substitute Specification.

In light of amendments to claim 6, Applicants have cancelled claims 10 and 12 without prejudice or disclaimer.

In addition, Applicants are adding new claim 17 to the application. Claim 17, dependent on claim 6, recites that the apparatus used further includes a deposition film cover which is provided to a downstream region of the temperature adjustment side wall, and wherein during the plasma processing a deposition film is formed on the deposition film cover. Note, e.g., Fig. 1, and particularly the structure therein represented by reference character 13; and note also the description in connection therewith in the paragraph bridging pages 15 and 16 of Applicants' Substitute Specification.

Initially, it is respectfully requested that the present amendments be entered. In this regard, and noting especially portion of Applicants' specification referred to in the foregoing, it is respectfully submitted that the present amendments to do not raise any issue of new matter; and, noting, for example, previously considered claims 10 and 12, as well as previous arguments, it is respectfully submitted that the present amendments do not raise any new issues. Noting amendments to claim 6, as well as canceling of claims 10 and 12, discussed previously, and amendments to claims 15 and 16, discussed infra, it is respectfully submitted that the present amendments to the claims, at least, simplify issues on appeal; and, as discussed infra, it is respectfully submitted that the present amendments present all remaining claims in allowable condition. Noting, for example, clarification of arguments by the Examiner in the Office Action mailed June 2, 2005, it is respectfully

submitted that the present amendments are timely. While new claim 17 is being added, finally rejected claims 10 and 12 are being cancelled without prejudice or disclaimer, and thus the number of claims to be considered on the merits after entry of this Amendment are fewer than the number of finally rejected claims.

In view of the foregoing, it is respectfully submitted that Applicants have made the necessary showing under 37 C.F.R. §1.116(c); and that, accordingly, entry of the present amendment is clearly proper.

The rejection of claims 15 and 16 under the second paragraph of 35 U.S.C. §112, as being indefinite, the Examiner contending that there is insufficient antecedent basis for the recitation "said electrodes" in these claims, is noted. Claims 15 and 16 have been amended to recite a distance between the sample table and a gas supply plate, each of which is defined in claim 6 as presently amended. In view of amendments to claims 6, 15 and 16, it is respectfully submitted that the rejection under the second paragraph of 35 U.S.C. §112, is moot.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the prior art applied by the Examiner in rejecting claims in the Office Action mailed June 2, 2005, that is, the teachings of the U.S. patents to Satou, et al, No. 5,961,850, to Tokunaga, et al, No. 5,874,013, and to Ohtake, et al, No. 6,054,063, under the provisions of 35 U.S.C. §103.

It is respectfully submitted that these references as applied by the Examiner would have neither taught nor would have suggested the plasma processing method as in the present claims, utilizing the recited apparatus

including, inter alia the vacuum processing chamber having a side wall which includes a temperature adjustment side wall which is positioned in an upper part of the side wall of the vacuum processing chamber, the temperature adjustment side wall surrounding a plasma generation area located between a sample table (on which a sample is mounted) and a gas supply plate (from which a gas which contains at least carbon and fluorine for processing the sample is introduced), and a temperature control means for controlling a temperature of the temperature adjustment side wall by using a coolant medium, wherein, inter alia and concurrently with generating a plasma using an electron cyclotron resonance system in which a microwave having a frequency of from 300 MHz to 1 GHz is employed, a temperature of the temperature adjustment side wall of the vacuum processing chamber is controlled be in a range of 10° C - 120 ° C, and wherein a temperature control accuracy of the temperature adjustment side wall, in this step of controlling, is ± 5° C for restraining a gas species discharge from the temperature adjustment side wall which contains carbon and fluorine according to a plasma dissociation. See claim 6.

Thus, and as will be discussed further infra, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested a controlling of such temperature of the temperature adjustment side wall to be in a range of 10° C - 120 ° C, with a temperature control accuracy of this temperature adjustment side wall being ± 5 ° C, in a plasma operating method utilizing apparatus as in the present claims.

In addition, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such a

plasma processing method as in the present claims, having features as discussed previously in connection with claim 6, and, moreover, wherein the plasma generation produces a plasma in which an electron energy is in a range of from 0.25 eV - 1 eV; (see claim 7); and/or wherein, in the plasma generation, a drive of a plasma exciting power supply is carried out intermittently (see claim 9); and/or wherein the temperature of the region which forms the side wall of the vacuum processing chamber is controlled to have a temperature in the range of 30-50° C; and/or wherein the plasma processing method is an etching method (see claim 13), in particular, an etching method of an oxide surface (see claim 14); and/or wherein a distance between the sample table and the gas supply plate in the chamber is 50 - 100mm (see claims 15 and 16); and/or wherein the apparatus used includes a deposition film cover provided to a downstream region of the temperature adjustment side wall, and wherein during the plasma processing a deposition film is formed on the deposition film cover (see claim 17).

The present invention is directed to a plasma processing method, particularly suitable for etching an insulating film, such as a silicon oxide film of a wafer, using a plasma, in a vacuum processing chamber in which a plasma is generated using an electron cyclotron resonance system and wherein the plasma is formed utilizing the gas which contains at least carbon and fluorine. In particular, the present invention relates to such method, which is able to maintain a stable etching characteristic during a long period of operation.

In, e.g., various known plasma processes for oxide film etching, problems remain in obtaining a high etching speed, while obtaining a high

selection ratio, a low micro loading, and the passing-through of a deep hole. Note the first full paragraph on page 8 of Applicants' Substitute Specification.

An important problem in oxide film etching involves dissociation of the gas molecules as the plasma is being formed under the most suitable conditions for the etching of the oxide film. To address this problem, a new plasma generation source producing a high density plasma under a low electron temperature has been proposed, as discussed on page 8, lines 10-26, of Applicants' Substitute Specification. However, with the proposed technique, it has not been possible to provide a technique in which the oxide film etching characteristic has not changed over a long period of operation.

Against this background, Applicants provide a method wherein a high density plasma under a low electron temperature necessary for oxide film etching is achieved, in which a stable operation or a stable processing can be carried out, without a premature stopping of the etching. Applicants have found that by closely controlling the temperature of the temperature adjustment side wall, to a temperature constant within $\pm$ 5 ° C, objectives according to the present invention are achieved; and, in particular fluctuation of the etching characteristic can be restrained for a long period of operation. Note the paragraph bridging pages 11 and 12 of Applicants' Substitute Specification.

In particular, attention is respectfully directed to Fig. 6 and the discussion in connection therewith at page 31, lines 7-22, of Applicants' Substitute Specification.

It is emphasized that in connection with the present invention, the temperature adjustment side wall of the vacuum processing chamber is in a

range of 10° C - 120° C, together with the temperature control accuracy as in the present claims. With such temperature and control of the accuracy thereof, a fully stable etching characteristic can be obtained. Note page 32, lines 20-25, of Applicants' Substitute Specification; note also from page 33, line 8 through page 34, line 3 of Applicants' Substitute Specification, describing advantageous effects achieved according to the present invention.

It is emphasized that the present invention includes a finding by Applicants that adherence of reaction products to the temperature adjustment side wall varies greatly by slight fluctuations in a temperature of the side wall. And, accordingly, such change in adherence can be avoided by accurately controlling the temperature of the side wall to a relatively precise degree (e.g., ± 5° C), as in the present claims.

Satou discloses a plasma processing method, wherein locations above the specimen being processed are controlled to temperatures at which the reaction products do not solidify, and the locations below the specimen (e.g., lower part of the sample mount, inner bottom portion of the processing chamber, exhaust pipe, etc.) are controlled to temperatures at which the reaction products solidify. See column 1, lines 41-47. Note also column 1, lines 58-67. See column 3, lines 10-20, and Table 1 at line 25 of column 3, disclosing different temperature control regions with the temperatures thereof being controlled to different ranges. Note also the paragraph bridging columns 5 and 6 of this patent.

It is respectfully submitted that Satou, et al, would have neither taught nor would have suggested the presently claimed method, utilizing the apparatus as in the present claims, and, moreover, wherein the temperature

adjustment side wall of the vacuum processing chamber is in a range of 10° C - 120° C, together with a temperature control accuracy of the temperature adjustment side wall being ± 5 ° C for restraining a gas species discharged from the temperature adjustment side wall which contains carbon and fluorine according to a plasma dissociation, as in claim 6.

Applicants respectfully traverse the conclusion by the Examiner in Item 5 (vi) on page 3 of the Office Action mailed June 2, 2005, that the temperature controllers in Satou, et al, provide a temperature control accuracy that is ± 0 ° C, that is, within the claimed range. It is respectfully submitted that Satou, et al, only describes a rough temperature control at two regions of the apparatus; and it is respectfully submitted that this reference is silent with respect to temperature control accuracy. It is respectfully submitted that Satou, et al, would have neither taught nor would have suggested the temperature adjustment side wall temperature together with the temperature control accuracy thereof, and advantages thereof as achieved by the present invention.

In addition, attention is respectfully directed to column 3, lines 10-23 of Satou, especially together with column 3, lines 44-58 thereof. It is emphasized that in Satou, et al, the temperature of the inner side wall of the processing chamber is set within the recited range to prevent reaction products from adhering to the inner side wall at some locations and cause the reaction products to selectively adhere at other locations (e.g, to lower parts in the chamber), thereby minimizing possibility of foreign matter falling onto the surface of the wafer being etched or floating from the inner bottom of the processing chamber. To emphasize, it is respectfully submitted that Satou, et

al, would not had been concerned with temperature control accuracy as in the present claims, only being concerned with providing a temperature within the recited ranges (which could vary as long as they stay within the recited ranges). Contrary to the conclusion by the Examiner, it is respectfully submitted that Satou, et al, does not disclose nor would have suggested a control accuracy within the scope of the present claims, much less a temperature control accuracy of $\pm$ 0 ° C.

It is respectfully submitted that the secondary references as applied by the Examiner, Tokunaga, et al, and Ohtake, et al, would not have rectified the deficiencies of Satou, et al, such that the presently claimed invention as a whole would have been obvious to one of ordinary skill in the art.

Tokunaga, et al, discloses a technique for dry-etching a thin film on a semiconductor wafer, using radicals or ions in a plasma. As described generally in column 3, lines 25-50, this patent discloses that after forming a field insulating film with a LOCOS structure on the main surface of a semiconductor substrate and thereafter forming a semiconductor element in an active region enclosed by the field insulating film, and depositing a first insulating film on the whole surface of the substrate and thereafter depositing a second insulating film having an etching rate different from that of the first insulating film on the first insulating film, selectively producing dissociated species for maximizing the selection ratio of the second insulating film to the first insulating film by a specified technique; and selectively producing dissociated species for maximizing the selection ratio of the first insulating film to the semiconductor substrate by a specified technique. See also Table 5 in

column 9 of this patent. Note also column 7, lines 14-22; and column 8, lines 57-65.

Even assuming, arguendo that the teachings of Tokunaga, et al, were properly combinable with the teachings of Satou, et al, such combined teachings would have neither disclosed nor would have suggested the presently claimed subject matter, including wherein, concurrently with the plasma generating step, a temperature of the temperature adjustment side wall of the vacuum processing chamber is controlled to be in a range of 10° C - 120° C, together with a temperature control accuracy of the temperature adjustment side wall, in the controlling, being ± 5 ° C as in claim 6; and/or the other features of the present invention as discussed previously.

Ohtake, et al. discloses a method for plasma treatment of a substrate, which includes treating the surface of the substrate with a plasma generated using a pulse-modulated high-frequency electric field, the method being described most generally in column 2, lines 43-64. Note, also column 2, lines 65-67; column 3, lines 1-3 and 15-18; and column 4, lines 4-17. Note especially that at column 4, lines 5-11, it is disclosed that the electron temperature of the plasma during the plasma treatment is controlled at 2 eV or lower.

Even assuming, arguendo, that the teachings of Ohtake, et al, were properly combinable with the teachings of Satou, et al, and Tokunaga, et al, as applied by the Examiner, such combined teachings would have neither disclosed nor would have suggested the presently claimed invention, including control of the temperature of the temperature adjustment side wall to be in the range as in the present claims, together with the temperature control

accuracy, utilizing the apparatus as in the presently claimed method; and/or the other features of the present invention as discussed previously, and advantages of the present invention.

In view of the foregoing comments and amendments, entry of the present amendments, and reconsideration and allowance of all claims presently in the application, are respectfully requested.

To the extent necessary, Applicants petition for an extension of time under 37 CFR §1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (Case No. 520.37698CX1) and please credit any excess fees to such deposit account.

Respectfully submitted,

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Attachments